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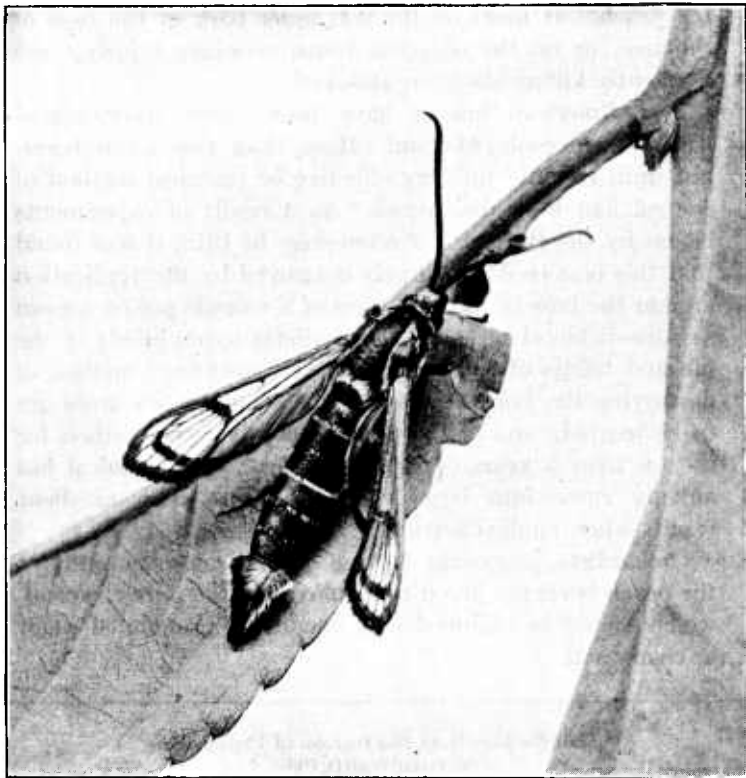
# THE PEACH BORER

HOW TO PREVENT OR LESSEN ITS RAVAGES

The Para-dichlorobenzene Treatment

A. L. QUAINANCE

Entomologist in Charge, Fruit Insect Investigations



FARMERS' BULLETIN 1246

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THE so-called peach borer, the larva of a beautiful clear-winged moth, has been for upward of 150 years one of the principal drawbacks to the successful cultivation of the peach. It feeds on the soft inner bark at the base of the tree, or on the adjacent roots, seriously injuring and frequently killing the trees attacked.

Few American insects have been more experimented with by entomologists and others than the peach borer, but until recently no very effective or practical method of control had been discovered. As a result of experiments begun by the Bureau of Entomology in 1915, it was found that this pest could be largely destroyed by the application around the base of infested trees of a volatile poison known as para-dichlorobenzene. This bulletin treats briefly of the life and habits of the insect; of the "worming" method of destroying the borers, suitable where only a few trees are to be treated; and of the para-dichlorobenzene method for use on trees 6 years of age and older. The chemical has already come into large commercial use with excellent results when applied according to directions.

Orchardists proposing to use para-dichlorobenzene for the peach borer are urged to employ only the pure chemical, which should be obtained of a fineness of granulated sugar or coarse salt.

Contribution from the Bureau of Entomology  
L. O. HOWARD, Chief.

Washington, D. C.

October, 1921

# THE PEACH BORER:<sup>1</sup> HOW TO PREVENT OR LESSEN ITS RAVAGES; THE PARADICHLOROBENZENE TREATMENT.

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## A VERITABLE SCOURGE.

Among insect pests attacking the peach few, if any, are more important or more serious than the peach borer. Its injuries each year, including the cost of control measures, amount probably to not less than \$6,000,000. Throughout much of its range of distribution east of the Rocky Mountains, from Canada south to Florida, it is a veritable scourge and must be combated relentlessly if the peach is to be grown. Trees of all ages, from those in the nursery to the oldest relic, are subject to attack. In many parts of the country the insect is so abundant that most trees in orchards become infested within a year or so after planting.

The peach borer is a native insect and has been complained of in horticultural and other literature almost from the time of the introduction of the peach in this country by the early settlers. Its original food plants were doubtless the wild cherry and wild plum, and on these it can still be found. It attacks also other stone fruits, such as nectarine, apricot, prune, almond, plum, and a few other plants. It is, however, preeminently injurious to the peach.

## CHARACTER OF INJURY.

Injury is done by the larva, or borer, in the course of its feeding. Trees are injured principally at or somewhat below the ground level, and galleries or burrows are eaten in the soft bark or cambium at the crown of the trees or along the larger roots (fig. 1). Young trees may soon be more or less girdled (fig. 2) and older trees so injured that their vitality and crop-bearing capacity are greatly reduced.

<sup>1</sup> *Aegeria exitiosa* Say; order Lepidoptera, family Sesiliidae.

Injured trees are, perhaps, more subject to infestation by certain diseases, such as root-rot, crown gall, and peach yellows, and are certainly less able to withstand periods of drought.

Infestation of trees by the borer is usually shown by an exudation, around the crown, of jellylike gum, more or less mixed with dirt and

small brown pellets—the excrement, or frass, voided by the borers in the course of their growth (fig. 3). This exudation of gum is especially evident during moist or rainy weather.

### HOW THE INSECT DEVELOPS AND LIVES.

The peach borer, in the course of its life, goes through four distinct stages—the egg; the larva, or borer; the pupa; and the adult, or parent moth.

#### THE EGG.

The eggs of the peach borer are small and inconspicuous, reddish brown in color, oblong in shape, and measure about  $\frac{1}{30}$  inch in length (fig. 4). They are deposited rather promiscuously over the trunk, limbs, and foliage of the peach tree, and many eggs are laid on weeds and trash or on the ground at or near the base of the trees. The eggs hatch in about 10 days, though this period may vary somewhat. The



FIG 1.—The peach borer in its galleries at the crown of the peach tree.

abundance and destructiveness of the peach borer is due, in considerable part, to the fact that the moths are very prolific. Observations on the number of eggs deposited by a given female show that she may lay as many as 829 eggs, with an average of about 400.

## THE LARVA OR BORER.

When the egg has hatched, the little larva coming out of it makes its way as rapidly as possible to the collar of the tree, if not already at or near its base, and at once begins burrowing into the bark, entering often through a crack or wound. Some of the larvæ enter on the trunk, or even on the limbs, but these usually fail to survive long. After the larva has gained entrance to the soft bark of the tree it feeds greedily and grows rapidly, and in the course of a few weeks has become of sufficient size to do material damage.

The number of larvæ which may infest a single tree is often surprising, and it is a matter of wonder that trees so infested are not completely killed within a season. The average number of larvæ to a tree in orchards varies widely according to region, in some sections there being only 2 or 3, whereas in other regions some 8 or 10 borers are usually present. In extreme cases 40, 60, and even 90 borers have been found infesting the roots and crown of individual peach trees 6 or 7 years old.

There is only one generation a year. The larger borers pass the winter in their burrows in the bark, though many of the smaller ones construct a cell, or hibernaculum, outside of the burrow on the bark of the tree. Feeding is active from early spring until late fall and, in the South, also during warm



FIG. 2.—Young peach tree practically girdled by the peach borer.

periods in the winter. Larvæ varying from quite small to nearly full grown are to be found in the trees during summer; during late

spring, however, they are more nearly of full size. The mature peach borer (fig. 5) is about an inch long, yellowish-white, with dark reddish head. On the body are a few brownish hairs arising from tubercles.

#### THE PUPA.

The peach borer, when full grown and ready to change its form, incloses itself in a cocoon composed of silk, in which are incorporated particles of bark and excrement, forming a tough, brownish, capsule-like structure. The cocoon (fig. 6) is usually constructed at the head of or somewhat beyond the larval burrow, and, owing to its similarity in color to that of the bark of the tree, it is often overlooked by orchardists. Borers infesting the roots some inches from the base of the tree may work directly upward to the surface of the soil and there construct their cocoons. Sheltered within the cocoon the larva changes to a pupa, or chrysalis. The pupa (fig. 7) is about three-fourths of an inch in length, brown, and provided with stiff spines on the back to assist it in working itself out of the cocoon, thus facilitating the escape of the moth. Within three or four weeks the pupa is fully developed and wriggles



FIG. 3.—Gum and frass exuding from base of peach tree, the usual sign of infestation.

out of the cocoon, the emerging moth leaving the empty skin protruding more than halfway from the cocoon (fig. 6).

**THE MOTH.**

The moths of the peach borer are beautiful clear-winged insects, the male differing strikingly from the female in markings. In the male (fig. 8) the wings are transparent, with steel-blue trimmings along the margin and veins, and the abdomen is marked with narrow yellow bands, quite conspicuous on the steel-blue ground color. The female (fig. 9) is steel-blue, with opaque forewings, and there are one or two orange-colored bands around the abdomen.

The adults are day fliers and, owing to their general resemblance to wasps when on the wing, are at times mistaken for these. Very soon after emergence mating takes place and oviposition begins. It is doubtful whether the moths feed to any extent during the course of their lives, and within a few days the eggs have been deposited and the moths have died.

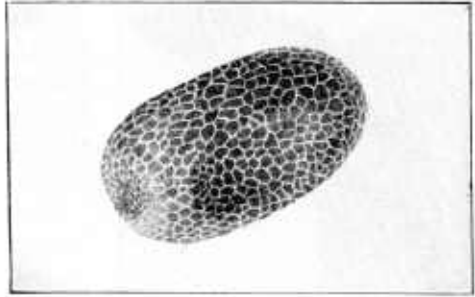


FIG. 4.—Egg of the peach borer moth. Considerably enlarged.

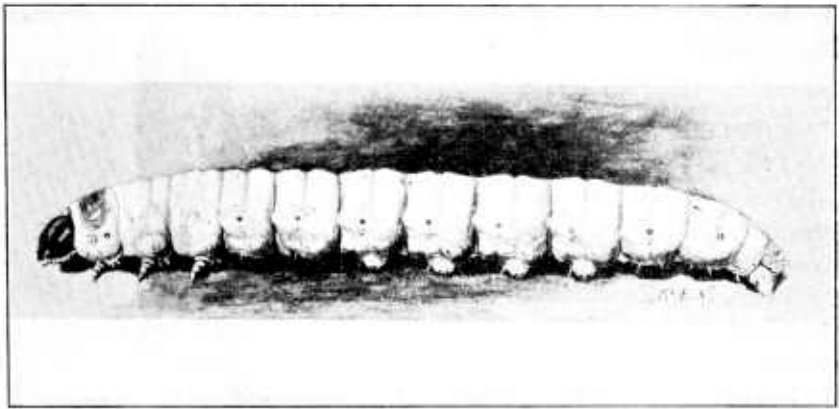


FIG. 5.—The peach borer. Enlarged.

**HOW TO CONTROL THE PEST.**

Many methods of control of the peach borer have been proposed during the more than 150 years that this pest has been known to injure the peach. Horticultural literature contains numerous accounts of the experience of growers with this or that wash or method of treatment of the borer, and entomologists, during the last 20 or 30 years, have given much time to discover, if possible, ways and means of preventing or reducing its injuries. While some of the washes and



procedures recommended undoubtedly have reduced infestation, they have not afforded the trees adequate protection. Commercial peach growers for the most part have depended upon "worming" the trees. A few use a wash on the trunk after worming, or mound the earth around the trees, or do both, but the great majority have followed no other method than worming the trees in the fall or spring, the more careful growers worming during both seasons.

Worming of peach trees has always been a bugbear to the commercial orchardist. It is a disagreeable and arduous task and likely to be slighted by the worker. Unless done conscientiously and thoroughly, with due care to remove all borers and not to injure the trees, worming is of questionable expediency. A decidedly



FIG. 6.—The peach borer cocoon and empty pupal skin. Enlarged.

better method of borer control, especially valuable for commercial growers, has been developed by the Bureau of Entomology and is described on pages 10–14. Careful worming of trees, however, may be preferred by some, especially where only a few trees are involved, as in small home orchards.

#### "WORMING."

Previous to worming, the earth should be removed from around the crown of the tree to a depth of 4 or 5 inches, and, if feasible, the trunk brushed or scraped to remove loose bark and dirt. With a little experience the worker can readily locate the borers in their burrows



FIG. 7.—Pupa of the peach borer. Enlarged.

and remove them by means of a knife or other suitable tool. In worming care should be taken not to cut the sound bark more than necessary, and the cutting should be done vertically. Carelessness in the use of worming tools may result in as much damage to trees as that caused by the insects. After trees have been wormed it is desirable, if practicable, to go over them again a few days later, when the location of any larvæ missed during the first examination will usually be indicated by the exuded excrement or frass. When the worming has been completed the earth should be replaced around the trees—in the fall, always before freezing weather sets in.

After spring worming, a wash can be applied, or the earth mounded somewhat around the base of the tree, or the wash and mound may

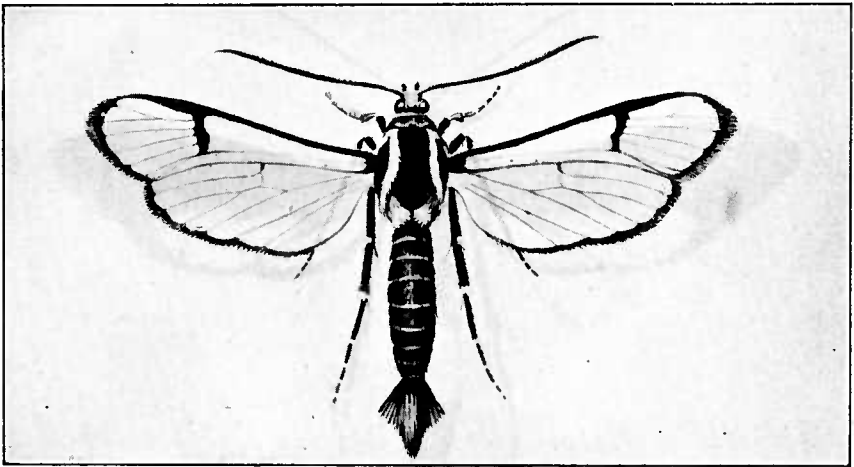


FIG. 8.—Adult male of the peach borer. Enlarged.

both be used (fig. 10). There is little if any advantage in the use of a wash, or in mounding, after the fall worming, since infestation occurs during the summer and early fall. The mounding will cause the borers to enter the bark somewhat higher, facilitating their detection and removal. If washes or wrappings are to be used they should be put on at once after the spring worming and before the earth is replaced around the trees. Perhaps as good a wash as any can be made from lime-sulphur concentrate (33° Baumé), used at the rate of 1 part to 6 or 7 parts of water, to which an amount of lime has been added to give it the consistency of heavy paint. A caustic wash can sometimes be used to advantage in the fall to destroy any little borers more or less exposed on the tree. For this purpose use caustic soda or lye at the rate of 1 pound to 8 or 9 gallons of water, and to this, after careful slaking, add about 10 pounds of stone lime.

**THE PARA-DICHLOROBENZENE TREATMENT.**

In 1915 the Bureau of Entomology began experiments in the use of various toxic gases as a possible means of control of the peach borer. This work, carried out by Mr. E. B. Blakeslee and continued for several seasons, covered a wide range of soil, climatic, and seasonal conditions, and demonstrated the usefulness for borer control of para-dichlorobenzene and the impracticability of using carbon disulphid, sodium cyanid, and certain other materials. Many experiments with para-dichlorobenzene showed that when properly used it is uniformly effective in killing a high percentage of the borers without injurious results to trees 6 years of age and

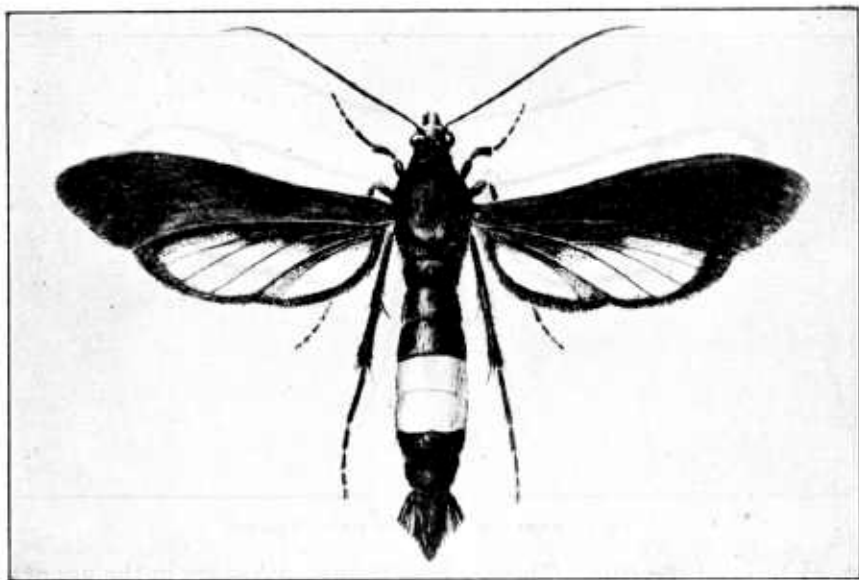


FIG. 9.—Adult female of the peach borer. Enlarged.

over. The results were published in United States Department of Agriculture Bulletin No. 796 (Oct. 21, 1919), and resulted in the prompt adoption of the treatment by many commercial peach growers. There has now been accumulated a sufficient body of experience, based on large-scale commercial use, and further experiments by the bureau and others, principally the New Jersey Agricultural Experiment Station, to show that a practical economic method of control has been found for this heretofore almost invulnerable pest.

**PARA-DICHLOROBENZENE DESCRIBED.**

Para-dichlorobenzene, for which the abbreviated name "paradichlor" is suggested when referred to as an insecticide, is a white crystalline substance having an etherlike odor, and vaporizing readily under

favorable conditions. The vapor, while harmless to persons and domestic animals under ordinary conditions, is poisonous to insects confined in its fumes for a sufficient length of time. Its vapor is heavier than air and readily permeates the soil. The chemical is, for practical purposes, noninflammable, and the fact that it is a finely divided solid adds much to the ease with which it may be applied. As usually sold it is a little too coarse for rapid volatilization, and orchardists in purchasing it should specify that they be furnished with a grade of the fineness of granulated sugar or coarse salt. Only the pure article should be purchased. Should there be some loss by evaporation in the containers the remainder of the chemical is

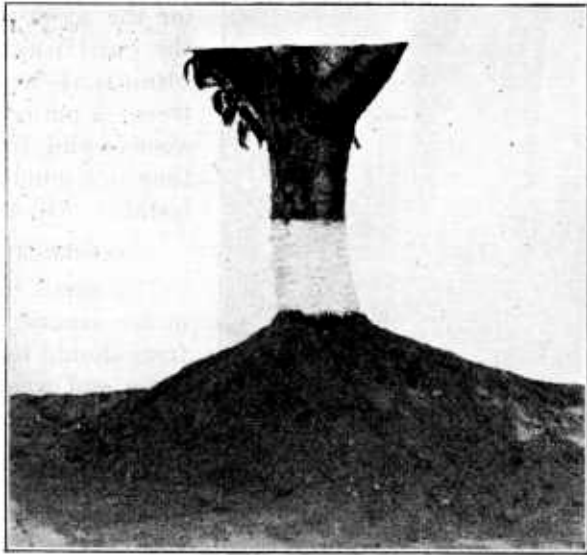


FIG. 10.—Peach tree to which a wash has been applied and earth mounded around the base.

always 100 per cent pure. If mixed with some inert material, the loss by evaporation of the “paradiçhlor” will result in a weakened mixture difficult to employ at a known strength.

#### WHEN TO APPLY IT.

The application of “paradiçhlor” to peach trees for the control of the peach borer should be made in the fall, after most of the moths have oviposited, to avoid late infestation of the trees. At this time many of the larvæ are still small and more or less exposed, and hence more susceptible to the gas than if deep in their burrows on the crown and roots. Applications must not be delayed, however, until the soil temperature is so low that proper volatilization of the chemical will not result. Many studies have been made as to the soil temperature

conditions best for the application of "paradichlor" and the following dates tentatively decided upon as best on the average for the respective regions:

Michigan, Ohio, Connecticut.....	September 1.
New Jersey, West Virginia, Maryland.....	September 10.
North Carolina and the Ozarks.....	September 25.
Georgia and Texas.....	October 10.

There are, however, limited seasonal variations in time of cessation of egg laying by moths in the fall. If applications of "paradichlor"



FIG. 11.—Preparation of ground previous to applying paradichlorobenzene and method of application of the chemical.

are made as indicated, any belated young larvæ as they hatch will be killed for the most part during the continuance of the chemical around the trees—a period of several weeks—and beyond this time not much, if any, infestation will occur.

#### PREPARING THE TREES.

The earth for 15 or 18 inches around the base of trees should be cleaned of grass and weeds and leveled off, without, however, digging up the soil any more than necessary to break the surface crust (fig. 11). If borers are present in the trunk of the trees somewhat above the ground level, as indicated by the presence of gum or

frass, a few shovelfuls of earth should be thrown around the tree and leveled off to form a bed for the application of the "paradichlor" high enough to subject the infested trunk to the fumes of the gas. As a rule the raising of the soil level around the tree will be unnecessary and is undesirable as favoring the washing down of the mounds by rain and interfering with the effectiveness of the treatment. If there is a decided mound of earth around the collar of the tree, this should be scraped down level with the surrounding soil. Excessive gum and frass should be removed and the bark lightly scraped. Exposed roots should be covered with a light layer of soil, since these are less resistant to gas fumes than the bark of the trees.

## APPLYING THE "PARADICHLOR."

After the soil around the base of the tree has been prepared the "paradichlor" is applied evenly in a circular band an inch or two wide entirely around the tree, care being taken that the inner part of the band is about 2 inches from the tree trunk (fig. 11). Use 1 ounce per tree, by weight, or somewhat more for very large trees, and for convenience in measuring the chemical a small bottle or wooden or tin box holding just the desired amount may be employed. As soon as the chemical has been applied, cover it carefully with several shovelfuls of dirt, making a cone-shaped mound around the tree trunk by packing the earth with the back of the shovel (fig. 12).

## IMPORTANT POINTS TO REMEMBER.

Under average fall weather conditions, with soil temperature around 60° F., or higher, most of the "paradichlor" under the soil covering will have evaporated in four to six weeks, killing from 90 to 100 per cent of the borers. Cooler weather than this, and frequent rains which keep the soil more or less wet, will greatly retard evaporation of the "paradichlor." Under these con-



FIG. 12.—Earth mounded around the base of peach tree to cover the para-dichlorobenzene.

ditions, and in general practice if feasible, mounds should be removed some five to six weeks after application of the chemical, so as to avoid subjecting the tree further to the gas on account of danger of injury. From present knowledge, orchardists are taking undue risks, especially in case of applications later than above indicated, in allowing the mounds to remain around the trees over winter—a practice that has been frequently observed. Labor arrangements should be made to put on the chemical at the right time for its proper evaporation. In large commercial operations the work could well be divided into sections, with the necessary number of men in each section, under a competent foreman, to carry it along expeditiously. One group of men could prepare the trees for the "paradichlor," another group apply the chemical, and the third group follow immediately to cover and mound the trees.

**DANGER OF INJURING TREES.**

Most materials effective in killing insects will also injure trees when used in large dosages. In the successful use of insecticides it is necessary to ascertain the minimum amount which will kill the insect and which will not injure the plants treated. Para-dichlorobenzene is a good example of such a chemical where the margin of safety is adequate for its practical employment as an insecticide, but where care on the part of users must always be employed. Close adherence to the directions given, as to the time, method of application, and dosage, is urged upon the users of the "paradichlor" method of peach-borer control. In the experiments of the Bureau of Entomology when so used, no injury has been noted to trees 6 years of age and over, and its use on trees younger than this is not recommended.

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December 20, 1923.

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<i>Fruit Insect Investigations</i> .....	A. L. QUAINANCE, <i>Entomologist in</i> <i>Charge</i> .

